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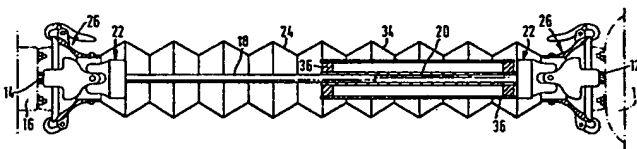
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⑤④ **Safety guard for power-take-off shaft.**

⑤⑦ A guard for a power transmission shaft such as a tractor pto shaft 18,20 comprises a flexible convoluted tubing 24 with end couplings 26 which together totally enclose the rotating parts. The tubing 24 can extend and retract axially to suit a variety of shaft lengths, and can flex transversely to accommodate turning of the tractor/implement combination. A tube 34 journaled on bearings 36, or equivalent bearing means, prevents damage to the tubing 24 by the shaft 18, 20.



**EP 0 086 606 A1**

"Safety guard for power-take-off shaft"DESCRIPTION

This invention relates to a safety guard which is particularly, but not exclusively, suitable for use  
5 with the power-take-off (pto) shaft between an agricultural tractor and a towed implement.

The current general practice is to provide a generally cylindrical shield which covers most of the pto shaft, but does not extend over the couplings at  
10 its ends which are guarded by shields of inverted U-shape on the tractor and implement. Thus the pto system is not fully enclosed, and accidents occur for example by loose clothing falling through a gap between shields and becoming caught. Also, existing  
15 shields tend to become damaged in use, and are frequently removed by users.

Various proposals have been made for improved safety guards. Reference is particularly made to two prior proposals. In GB-A-799,402 there is shown a  
20 guard made of reinforced flexible convoluted tubing; however this is not totally enclosed at its ends, and no provision is made for mitigating wear of the tubing caused by its rubbing on the rotating shaft. FR-A-1,208,959 shows a guard which completely encloses the  
25 pto shaft and couplings, but the guard is rigid and a complex arrangement is required to allow it to follow movement of the shaft on relative turning between the tractor and implement.

In accordance with the present invention, there  
30 is provided a guard for a power transmission shaft between a prime mover and a powered accessory whose orientation with respect to the prime mover may change, the guard comprising a flexible tubular member capable of axial extension and retraction and capable of  
35 axial bending but resistant to radial compression, and

coupling means on each end of the tubular member adapted for attachment to the prime mover and the accessory respectively, the coupling means when so attached causing the rotating parts to be totally  
5 enclosed.

The tubular member is preferably of convoluted rubberised cloth reinforced with steel wire.

Preferably, a bearing means is arranged between the tubular member and a shaft therethrough. In a  
10 preferred form the bearing means comprises a metal tube carried by bearings at its ends journaled on said shaft. As an alternative, bearings may be secured at the innermost points of the convolutions of the tubular member.

15 An embodiment of the invention will now be described, by way of example, with reference to the accompanying drawings, in which:-

Fig. 1 is a diagrammatic cross-section of apparatus according to the invention; and

20 Fig. 2 is a similar view of one end of the apparatus in disassembled condition.

Referring to Fig. 1, a tractor 10 has a splined pot 12 coupled to a splined power input 14 of an implement 16 via a pto shaft. As is conventional,  
25 the pto shaft comprises telescopic shaft parts 18, 20 and universal joints 22, the parts 18, 20 being telescopic to accommodate relative movement between the tractor 10 and implement 16 when turning or traversing bumpy ground.

30 In accordance with the invention, the pto shaft 18-22 is totally enclosed by a guard comprising a flexible tube 24 and quick-release end couplings 26. The tube 24 is of convoluted form, made of rubberised cloth reinforced with steel wire. The tube 24 is  
35 capable of bending in any direction and of extending and retracting in length, but is resistant to inward

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deformation.

As best seen in Fig. 2, the end couplings 26 cooperate with part-spherical housings 28 secured to the tractor and implement in place of the conventional inverted-U guards. Hook-shaped clamps 30 cooperate with a raised lip 32 on the housing 28 to secure the coupling 26 in place. Larger couplings may be used, for example where an over-run clutch is fitted at the pto.

Returning to Fig. 1, a metal tube 34 is freely rotatable on the pto shaft part 20 by means of end bearings 36. Thus, if the flexible tube 24 is forced towards the pto shaft, the tube 24 will contact the metal tube 34 which will stand stationary while the shaft 18,20 rotates within it; this minimises wear on the flexible tube 24. As an alternative (not illustrated), some form of bearing surface could be fitted to the inner face of the tube, for example in the form of bearings or hardened rubber secured at the inner diameters of the convolutions (in practice, these need only be provided in the central area of the tube 24), or the tube 24 itself may be hardened in this area.

It will be appreciated that the guard of the invention totally encloses the pto mechanism, and thus makes it impossible for a person to be inadvertently caught in the rotating parts.

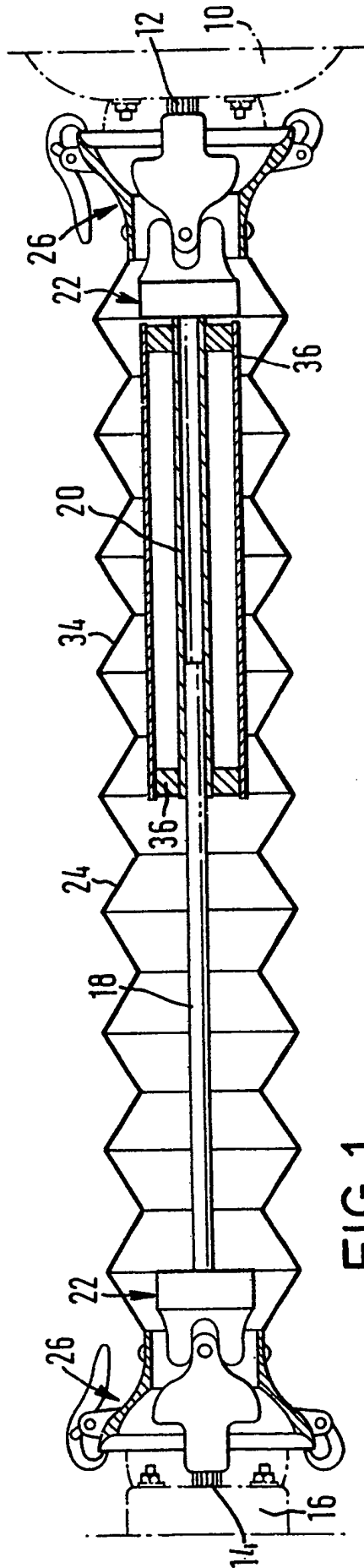
The guard has other advantages:

- It can be used in a standard form with transmissions of different lengths
- Only one guard per tractor is needed, rather than one per implement
- The guard is easily opened for lubrication and maintenance.

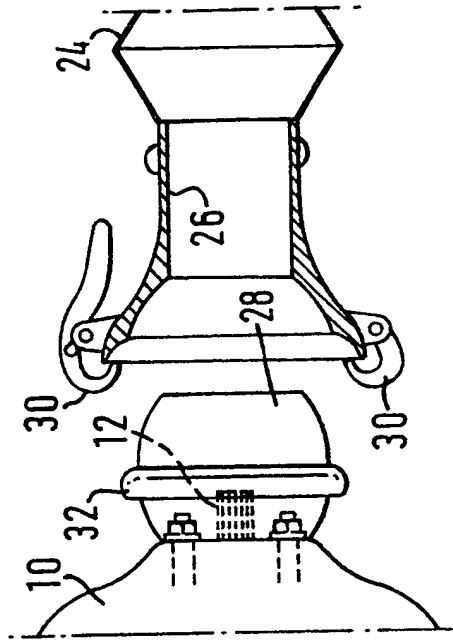
Although described with reference to tractor/implement pto's, the present invention can be used with other forms of machinery.

CLAIMS

1. A guard for power transmission shaft (18,20) between a prime mover (10) and a powered accessory (16) whose orientation with respect to the prime mover may change, the guard comprising a flexible tubular member (24), characterised in that the tubular member (24) is capable of axial extension and retraction and of axial bending but resistant to radial compression, and in that the tubular member (24) is provided at each end with coupling means (26,30) adapted for attachment to the prime mover and accessory, respectively, the coupling means (26,30) when so attached causing the rotating parts (12,14,18,20,22) to be totally enclosed.
2. The guard of claim 1, in which the tubular member (24) is of convoluted rubberised cloth reinforced with steel wire.
3. The guard of claim 1 or claim 2, including a bearing means (34,36) within the tubular member (24) for engagement with the shaft (18,20) when the tubular member (24) undergoes axial bending.
4. The guard of claim 3, in which the bearing means comprises a metal tube (34) carried by bearings (36) at its ends journalled on said shaft (18,20).



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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 3)
Y,D	GB-A- 799 402 (ATKINSON'S AGRICULTURAL APPLIANCES LTD.) * Page 2, lines 4-23; figures 1,2 *	1,2	A 01 B 71/08 F 16 D 3/84
Y,D	--- FR-A-1 208 959 (BIRFIELD ENGINEERING LTD.) * Whole document *	1	
A	--- GB-A-1 194 040 (VAN DER LELY) * Page 2, lines 59-70; figure 1 *	1,2	
A	--- GB-A- 776 888 (WALTERSCHEID) * Whole document *	1	
A	--- DE-B-1 217 126 (GERSTENBERG)		TECHNICAL FIELDS SEARCHED (Int. Cl. 3)
A	--- GB-A- 761 389 (PULLMAN SPRING-FILLED CY. LTD.) -----		A 01 B F 16 D
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 20-05-1983	Examiner VERDOODT S.J.M.
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	